

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listing, of claims in the application:

Listing of Claims:

1. (currently amended) A process for purifying hydrogen from a stream of reformate gases comprising:
 - a. preparing a flow cell in which 2 gas flows are separated by a two-phase solid state ceramic membrane, wherein the first phase is ionically conducting and the second phase is electronically conducting,
 - b. heating said cell to greater than 500 °C,
 - c. passing said reformate gas ~~and a small amount of steam~~ on one side of said membrane and steam on the second side of said membrane,
 - d. separating said purified hydrogen from said second side of said membrane.
2. (original) The process of claim 1 wherein said reformate gases are selected from the group consisting of:
 - a) mixtures of carbon monoxide and hydrogen;
 - b) mixtures of carbon monoxide and hydrogen containing small quantities of other hydrocarbons or hydrocarbon reformate or inert gases such as Ar, He or nitrogen;
 - c) by-products from the partial oxidation or steam reformation of methane;
 - d) partial oxidation or steam methane reformation products of other hydrocarbons;
 - e) products of carbon dioxide reformation of hydrocarbons;
 - f) products of autothermal reformation of methane and other hydrocarbons; and mixtures thereof.
3. (canceled)

4. (currently amended) The process of claim 1 3 wherein the first phase of said membrane is selected from the group consisting of:

strontium doped lanthanum iron cobalt oxide of the composition $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$, where $0 < x < 1$ and $0 < y < 1$;

$\text{La}_{(1-x)}\text{Ca}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$, where $0 < x < 1$ and $0 < y < 1$;

$\text{La}_{(1-x)}\text{Sr}_x\text{Co}_y\text{Fe}_{y1}\text{Ni}_{y2}\text{Cr}_{y3}\text{O}_3$, where $x < 1$ and $y_1 + y_2 + y_3 + y_4 = 1$;

yttria stabilized zirconia doped with an oxide selected from the group consisting of MnO_2 , TiO_2 , FeO , Cr_2O_3 and other transition metal oxides;

undoped CeO_2 ;

CeO_2 doped with an oxide selected from the group consisting of MnO_2 , TiO_2 , FeO , Cr_2O_3 and other transition metal oxides;

~~yttria stabilized zirconia and a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au;~~

~~RE₂O₃ doped CeO₂, where RE is Y, Yb, Sc, or Gd, and a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au; and~~

~~$\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$ and Ni;~~

~~$\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$, where $x < 1$, $y < 1$, and Pd and mixtures thereof, where $x < 1$, $y < 1$, and $y_1 + y_2 + y_3 + y_4 = 1$.~~

5. (canceled)

6. (currently amended) The process of claim 3 1, wherein the first phase of said membrane is $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$, where $0 < x < 0.4$ and $0 < y < 1$.

7. (currently amended) The process of claim 3 1, wherein said membrane is $\text{La}_{0.9}\text{Sr}_{0.1}\text{Ga}_{0.8}\text{Mg}_{0.2}\text{O}_3 + \text{Pd}$.

8. (new) The process of claim 1, wherein the second phase of said membrane is a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au.
9. (new) The process of claim 4, wherein the second phase of said membrane is a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au.
10. (new) The process of claim 1, wherein the said membrane comprises:
a first phase comprising one or more of yttria stabilized zirconia doped with an oxide selected from the group consisting of MnO_2 , TiO_2 , FeO , Cr_2O_3 and other transition metal oxides, RE_2O_3 doped CeO_2 , where RE is Y, Yb, Sc, or Gd, and $\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$, where $x < 1$, $y < 1$;
and
a second phase comprising one or more of a metal selected from the group consisting of Pd, Pt, Ni, Ag and Au.
11. (new) The process of claim 1, further comprising including a small amount of hydrogen with the heated steam.
12. (new) The process of claim 11, wherein steam is present in the heated steam in an amount less than or equal to about 3wt%.
13. (new) A system for purifying hydrogen gas, comprising:
a source of reforming gas,
a source of steam,
a flow cell comprising a first oxidizing compartment and a second reducing compartment separated by a two-phase solid state membrane, wherein the first phase is ionically conducting and the second phase is electronically conducting,
means for directing the reforming gas across the membrane in the first compartment,
means for directing the steam across the membrane in the second compartment,

a condenser downstream from the second compartment for separating steam from hydrogen.

14. (new) A process for purifying hydrogen from a stream of reformate gases comprising:

- preparing a flow cell in which 2 gas flows are separated by a solid state membrane selected from the group consisting of:

strontium doped lanthanum iron cobalt oxide of the composition $\text{La}_{(1-x)}\text{Sr}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$, where $0 < x < 1$ and $0 < y < 1$;

$\text{La}_{(1-x)}\text{Ca}_x\text{Co}_{(1-y)}\text{Fe}_y\text{O}_3$, where $0 < x < 1$ and $0 < y < 1$;

$\text{La}_{(1-x)}\text{Sr}_x\text{Co}_y\text{Fe}_{y_2}\text{Ni}_{y_3}\text{Cr}_{y_4}\text{O}_3$, where $x < 1$ and $y_1+y_2+y_3+y_4=1$;

yttria stabilized zirconia doped with an oxide selected from the group consisting of MnO_2 , TiO_2 , FeO , Cr_2O_3 and other transition metal oxides;

undoped CeO_2 ;

CeO_2 doped with an oxide selected from the group consisting of MnO_2 , TiO_2 , FeO , Cr_2O_3 and other transition metal oxides;

RE_2O_3 doped CeO_2 , where RE is Y, Yb, Sc, or Gd; and

$\text{La}_{1-x}\text{Sr}_x\text{Mg}_y\text{Ga}_{1-y}\text{O}_3$, where $x < 1$, $y < 1$, and mixtures thereof,

- heating said cell to greater than 500°C ,
- passing said reformate gas on one side of said membrane and steam on the second side of said membrane,
- separating said purified hydrogen from said second side of said membrane.